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DEVELOP SUPPLY OR DEWATER

# Well-Point Systems Can Do the Job

*(Continued from September-October issue of the* JOURNAL*)*

• *The first part of this article, presented in the September-October issue of the* JOURNAL, *described the principles of design of well-point systems for developing relatively large quantities of ground water for irrigation and municipal supply.*

Thus far, we have pointed out some of the fundamental principles that govern the design of well-point systems for developing shallow ground-water supplies for irrigation, municipal and industrial use.

Well-point systems find another practical application where it is desired to obtain supplies of sea water for salt-water bathing pools in clubs and resorts. The well-points are sunk in the saturated sand of the ocean beach. Such an installation conveniently provides clean ocean water, naturally-filtered through the beach sand. The well-points and piping are installed as far out as practicable during periods of low tide. Pumps are suitably located above high tide, often in water-tight pits below ground surface. The header pipe and suction line to the pump must be suitably anchored to piling, or otherwise protected, to prevent damage from the pounding of the surf.

Systems of this kind are popular along our eastern coast from New Jersey to Florida. Four-inch, six-inch, and eight-inch well screens are used as well as the smaller well-points and, of course, the screens must be of corrosion-resistant metal to last in sea water. Everdur metal, monel and cupro-nickel alloys all give good service under these conditions.

## Dewatering Systems

The rest of our discussion about well-point systems is concerned primarily with their use to temporarily dewater construction sites in wet ground. Trenches for sewers and water mains and excavations for foundations often have to be carried down into saturated soil below the normal water table. Pulling the water table down by pumping a well-point system installed adjacent to the area to be excavated, permits working "in the dry." In most cases, it is more economical to dewater with well-points than to surround the excavation with a continuous wall of sheet piling and pump from within the work area. Proper dewatering also eliminates the hazards of "sand boils" developing in the bottom of the excavation.

The economy of using well-point systems for dewatering was not fully appreciated by American contractors until about 1930, although the practice had been highly developed in Europe many years before. An individual job here and there was dewatered by crude installations in the United States as long as 40 or 50 years ago, but no engineering was applied to design the system to fit the geological and ground-water conditions. As recently as 25 years ago, contractors and engineers

Photo courtesy **Diesel Power Co.**

**Representing highly favorable conditions, a single two-inch Red Head well point, 6 feet long, in a driven well near Sand Springs, Oklahoma, was pumped at 140 gpm on test. This well is shown here delivering water thru a series of sprinklers.**

Well-point system installed on an ocean beach in Florida to obtain a supply of clear salt water for a swimming pool.

believed that well-point dewatering would work only where the saturated soil was clean sand, free from any silt or clay seams of low permeability. Improved design of well-points, pumps and other components, plus the application of the principles of ground-water hydraulics and the empirical knowledge gained from job experience, now permit successful dewatering of jobs formerly considered impossible.

The lowering of the ground-water level over the desired area of a construction site involves creating a composite cone of depression by pumping from the well-point system. To create a composite cone of depression, the individual cones of depression around each well must overlap. This means putting the wells close enough together so that they "interfere" with each other and thus pull the water table down several feet at intermediate points between pairs of wells. This is in direct contrast to the wide spacing of the wells in a system designed for water supply, which we described and illustrated in our previous article.

Well-points in a dewatering system are usually spaced from two to five feet apart, depending upon the permeability of the saturated sand, the depth to which the water table must be lowered and the depth to which the well-points can be installed in the water-bearing sand.

Figure 1 shows how the overlapping of the areas of influence around two small wells results in a composite depression of the water table. The water level will be kept down to the levels indicated as long as pumping is continued. Water is drained by gravity from the sand above the depressed water table and this soil can then be excavated as dry material anywhere within the composite cone of depression which is defined by the water levels shown in the illustration.

It should be pointed out that the formation of the composite cone of depression and the resulting draining or dewatering of the sand within this zone do not occur instantly upon starting to pump. Several hours of pumping are required to fully develop the drawdown in the saturated sand around each well-point. Additional time is required for vertical drainage of the water of saturation from the dewatered zone. In practice, this time element makes it necessary to start pumping from the well-point system a day or more before starting to excavate.

On large jobs, detailed pumping tests should be made to determine the best spacing of the well-points and the time required for draining the soil to the desired depth. Proper application of the non-equilibrium theory in analyzing the pumping test will give the answers to both these questions.

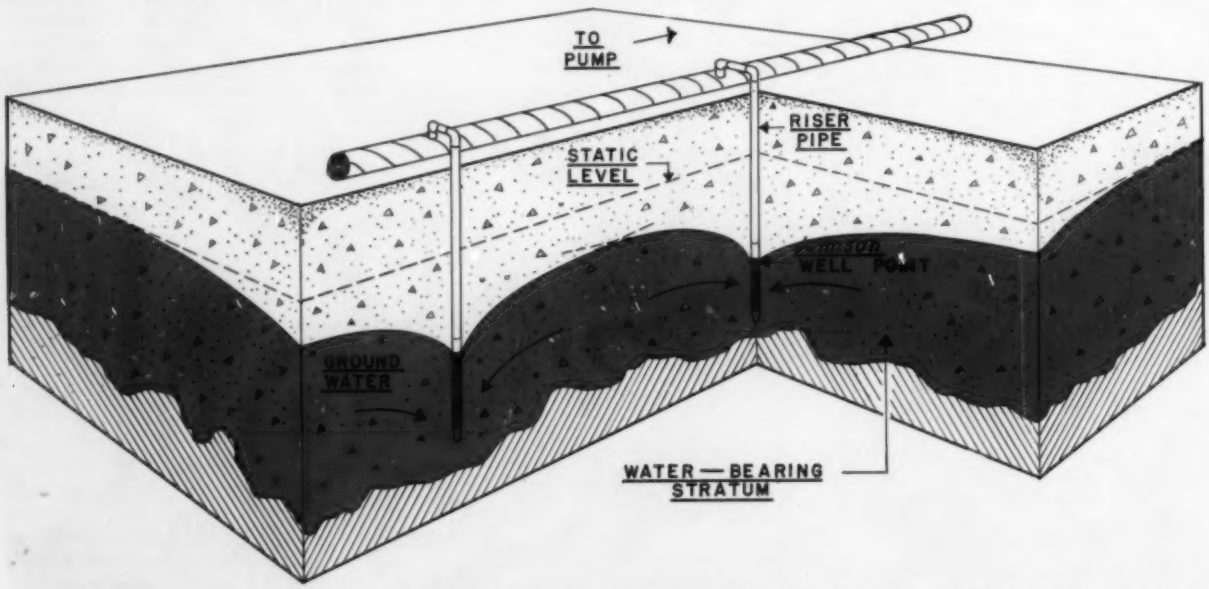


Figure 1. Temporary dewatering of an area to permit excavating under dry conditions below the normal water table is accomplished by pulling the water table down in the desired area by pumping from a series of closely-spaced wells. Wells for this purpose are located so their cones of depression will overlap and result in a composite depression in the water table. As long as pumping is continued, the dewatered portion as shown here can be excavated "in the dry." Wells are placed on two, three or all sides of the work site.

The maximum drawdown that can be maintained in the formation adjacent to each well is the vacuum or suction head in feet developed by the pumping equipment minus the distance from the center of the pump to the static water level and minus the head losses in the piping and the well-points themselves. The limitations imposed by the suction head that can be developed by the pump, which were discussed at some length in our previous article, apply equally here. Considerable advantage can be gained if it is possible to excavate initially almost to the static water level and then set the pumps at this lower elevation.

### Factors Affecting Drawdown

In any case, pumps that are specially designed for dewatering work cannot be depended upon to pull the water down in the formation adjacent to each well-point to a level more than 20 to 22 feet below the center of the pump. This means that on an average job where the sand is fairly permeable a single-stage well-point system can only dewater sufficiently to permit excavation in the dry to a maximum depth of about 16 feet below the pumps. This may mean lowering the ground-water level anywhere from one or two feet up to 15 feet, depending on the height above static water level at which the pumps are set.

The suction head of the pump thus imposes a definite limitation on the depth to which the soil can be dewatered by a single group of well-points. This limitation can be overcome, however, by using two or more separate systems installed in successive stages. Figures 2 and 3 illustrate this principle.

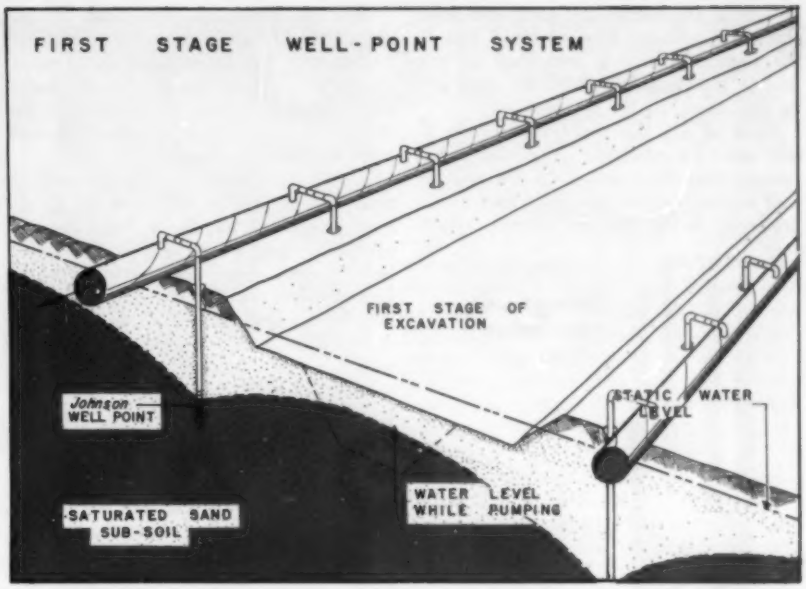


Figure 2. One or more stages of a well-point dewatering system may be required depending on the depth to which the water table must be pulled down. The first stage is installed, the desired area is pre-drained by it and excavation is carried down as far as possible before installing the second stage.

The first stage system is installed as in Figure 2. Pumping it lowers the water table enough to permit excavation several feet below the original ground-water level. The second stage system is then installed at the lower level as illustrated in Figure 3. The well-points, header pipe and pumps of the second stage are all set as far below the first stage as the conditions permit. Pumping this system then pulls the water level down sufficiently further so the excavation can be completed to the desired depth. A third stage may be added if even deeper dewatering is needed.

Continued pumping of the second stage system may drain the soil around the first well-points leaving them high and dry. Operation of the first stage is stopped if this happens. Pumps and other parts of the first stage can then be used on the second or third stage systems, but they will probably have to be re-installed in the first stage so it can be operated when the time comes to remove the lower stages.

Under favorable conditions, the water level can be pulled down in steps of about 15 feet by "stage dewatering." Steps of 10 to 12 feet per stage are more usual, however, and represent average conditions.

Two separate well-point systems may also be required where two strata of saturated sand separated by an impervious layer of clay are encountered. In such a case, one set of well-points may be sunk to the top of the clay in the upper sand and the other set carried down to the desired depth below the impervious layer in the lower sand.

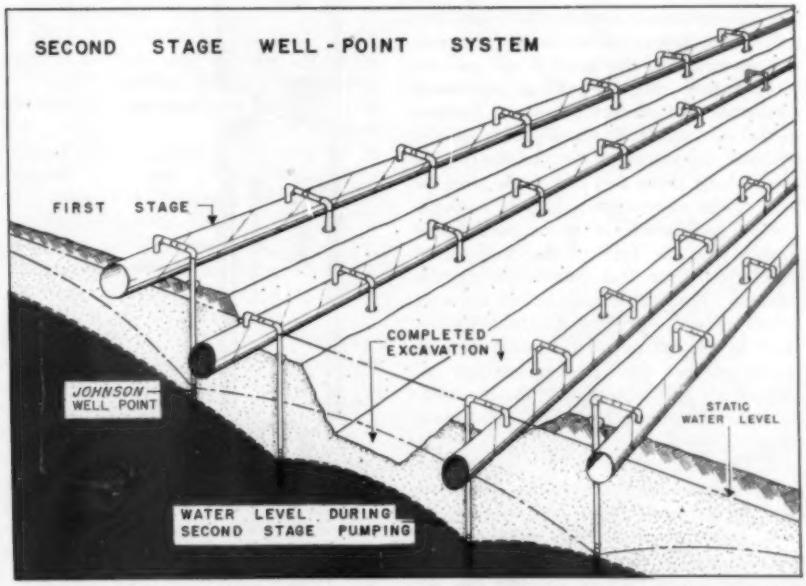


Figure 3. The second stage well-point system is installed at the lower elevation after excavating to the depth permitted by pumping from the first stage alone. Pumping the second stage then depresses the water table further to permit continuing the excavation to the desired depth.

### Efficiency Important

Our discussion of the maximum drawdown that can be produced by suction lift points up the importance of

designing the system for good hydraulic efficiency. Every foot of head loss in the system means a reduction of one foot in the depth to which the area will be dewatered by the system.

First of all, the well-point screen itself must be efficient. Experience has proven that the continuous-slot type of well screen, with V openings that widen inwardly, is the best on several counts.

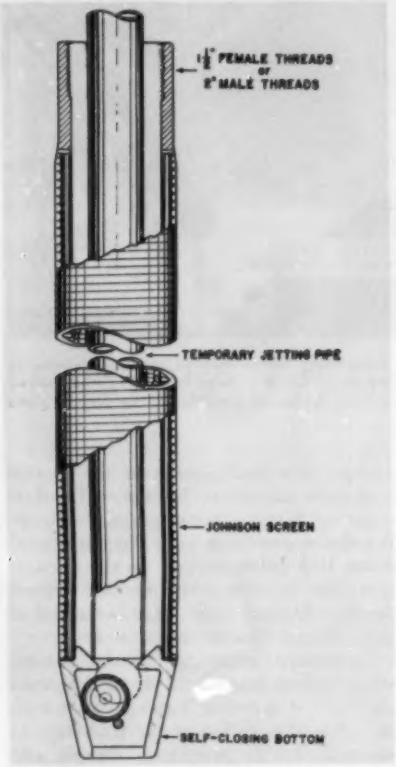


Figure 4. Johnson dewatering well point with self-closing bottom. Temporary jetting pipe is used and is pulled out when well point is sunk to desired depth.

The large inlet area of this screen results in low velocity through the openings and, consequently, minimum friction loss in the screen. The V shape of the screen slot openings prevents clogging that might otherwise build up extra resistance to flow. The V-shaped openings also permit removal of the finest particles of the formation leaving the coarser particles as an envelope around the well-point as a natural gravel pack. This local development of the formation around the well-point takes place when each well is being pumped out to clean it immediately after sinking it to the desired depth. Continuous-slot well-points can be obtained in wide range of sizes of openings which permits using the right screen to fit the grading of the water-bearing sand that is to be dewatered.

Second, sizes of pipe and fittings must be large enough to keep velocities reasonably low throughout the system. In some cases, a larger size of header pipe might be used in a portion of the system near the pumps where the volume of flow is greatest.

The third important step to take in making the system efficient is to do everything practicable to keep air out of the system when operating. Joints in the riser pipes, connections to the header pipe and joints and fittings of the header pipe must all be air-tight. A valve in each connection from riser to header pipe to control the flow from each well-point is most important. Every well-point will not operate the same because of variations in the character of the water-bearing sand from place to place over the area. Also, the effective suction head on the well points nearest the pumps is greater than on the more distant ones. One or more well-points may become unwatered and break suction for one of the these reasons and allow air to enter the system. The valve in each connection permits the troublesome wells to be throttled and the air leak to be stopped. The valve may also be completely closed so that an individual well can be repaired or cleaned without shutting down the whole system.

## Depth of Setting

The proper depth to which the well-points should be installed is influenced by three factors: (1) the maximum depth of the proposed excavation, (2) whether or not a bed of clay or rock will be encountered at this depth and (3) the existence and depth to any intermediate layers or seams of impervious material in the sand.

Assuming the water-bearing sand continues several feet below the bottom of the excavation, the well-points should be sunk deep enough so that their tops are at least three feet below the deepest part of the excavation. If only a single line of well-points is to be used for a trench job, the tops of the well-points should be four feet below the trench bottom. It is preferable to set the well points at even greater depths with respect to the bottom of the excavation if conditions permit. Deeper settings insure that the entire length of each screen will always be below the lowest pumping level.

If the excavation is to be carried down completely through the saturated sand to an underlying bed of clay or rock, some special steps need to be taken in setting the well-points to insure complete dewatering of the last one or two feet of the sand. With the well-points set just above the impervious bed, the water level can only be pulled down to the depth where air may enter the well screen and break suction. This may be at the top of the screen or, if the well-points are provided with center drop tubes, it may be about a foot above the bottom of the sand.

The well-points can be set low enough to dewater clear to bottom by sand-packing them in larger diameter holes cut into the impervious bottom to a depth of two or three feet. To do this, a six-inch or eight-inch temporary casing is jetted down from the ground surface to the required depth, the well-point and riser assembly is centered inside the larger pipe and the annular space around the well-point and riser is filled with clean, coarse sand. As the sand envelope is placed, the temporary casing is withdrawn. If the bottom is rock or hard shale that cannot be penetrated by jetting, it may be necessary to use a well drilling machine to cut the sumps into which the well-points are to be sand-packed. Whether or not the cost of cutting the sumps in a rock bottom may be justified on a particular job must be analyzed for each case.

The presence of tight layers of silt or

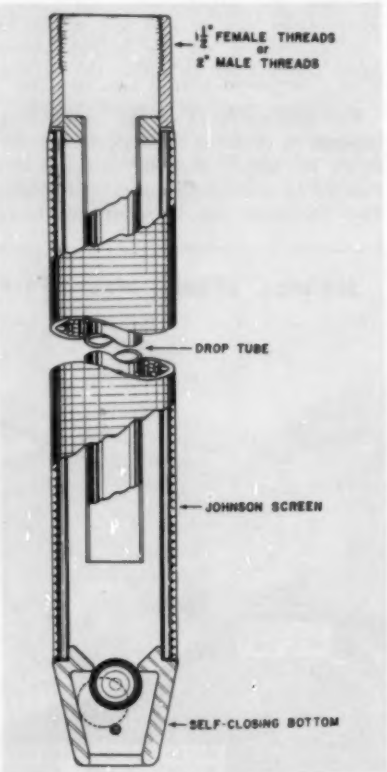


Figure 5. Johnson dewatering well point with center drop tube and self-closing bottom. Drop tube permits self-jetting and allows pulling water level down to bottom of screen without breaking suction.

**Mason County Well & Pump Service of Easton, Illinois, test-pumping two 6-inch wells, 63 feet deep, on suction lift. Static level is five feet. Pump is delivering 1000 gpm through 8-inch discharge pipe. Each well is equipped with a Johnson Well Screen, 10 feet long, with No. 25 slot openings.**

clay at various depths in the saturated soil complicates the design of the well-point system since they prevent vertical drainage of the sand lying above them. Even though these layers may be as thin as an inch or so, they are practically impervious. Successful dewatering of a stratified formation requires provision for draining each stratum of sand as a separate formation. We have already suggested that a two or three stage system may be needed for this purpose, with the well-points in each group installed at the bottom of each respective layer of sand.

Where conditions are not too troublesome, vertical drainage channels that pierce the impervious strata can be provided by sand-packing each well-point and riser pipe in eight-inch to twelve-inch diameter holes. In a manner like that we have already described, a large temporary casing is jetted down through all the strata, the well-point is centered in it and the annular space filled with clean coarse sand up to the static water level. The outer casing is pulled up as the sand-pack is put in. This sand envelope will sometimes provide the vertical drainage desired, although it does not always work for the reason that a skin of silt and clay may be formed on the wall of the large hole by the "trowelling" action of the temporary casing as it is withdrawn. This slick or skin cannot be removed above the top of the well-point since there is no way to get any development or washing action above the screen that will remove anything that is sandwiched between the natural formation and the outer base of the sand packing.

To determine the best depths of setting where stratification is apt to be a problem, it is worthwhile to put down a few test wells and pump them experimentally. The yield of the water-bearing formation should be checked at different elevations by successively setting and pumping the well-point in each test well at various depths. The well-point can be set to maximum depth first, then pulled up a few feet for a second test. In making the pumping test a vacuum gage should be used on the intake of the pump to measure the suction head. The rate of pumpage is measured by pumping into a container of known volume and timing the filling of it.

### Features of Well-Points

The reasons for the high efficiency of continuous-slot well-points have already been pointed out. These screens, made just like the well screens used in large permanent wells, are fabricated by winding a special-shaped wire around a skeleton of longitudinal rods. Each point of contact of the outer wires and rods is solidly welded. The resulting screen is a one-piece unit, strong and rugged, but with a high percentage of open area. It will stand a lot of abuse, a most important consideration, since dewatering well-points are installed and removed repeatedly.

Both the drive-type and the jetting-type of continuous-slot well-points are used for dewatering work. Although designed for driving, drive points are also frequently installed by first washing down a hole with a separate jetting pipe and then dropping the well-point and riser pipe in the hole which will be held open temporarily by the return flow of the jetting stream. Driving the points is less favored because it is slower.

Where the screens are to be sand-packed in larger holes for the reasons we have outlined above, the drive-type should be used for economy. Drive points are available with center drop tubes if desired.

The jetting-type well points equipped with self-closing bottoms are sunk into place, with riser pipe attached, by using a pump that will deliver 60 to 100 gpm at a pressure of at least 80 psi. Figure 4 shows a continuous-slot well-point with self-closing bottom. Figure 5 shows the same point fitted with a center drop tube.

The center drop tube serves two useful purposes but it also has some disadvantages. It permits jetting the well-point down without running a temporary jetting pipe inside the riser and screen. Secondly, the well-point with the drop tube will permit the water in the adjacent formation to be pulled down to the level of the bottom of the tube before breaking suction. This is obviously desirable where the well-

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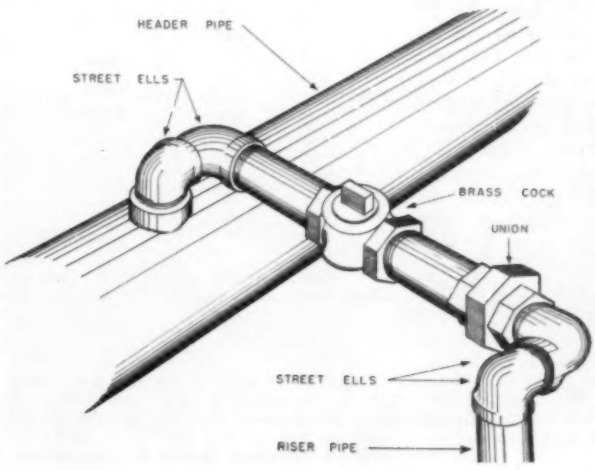


**Figure 6. Details of connecting fittings from riser pipe to header pipe. Made up of 1½-inch or 2-inch pipe fittings, the connection may be swung horizontally and vertically to meet the top of the riser pipe. This flexibility is important since, in practice, the well-point and its riser pipe will always be a few inches off the calculated position.**

# Improve Your Work With Drilling-Time Logs

*by* MAURICE E. KIRBY

An accurate record of the time (in minutes or seconds) required to drill each foot of a well produces what is called a "drilling-time log" of the hole. The technique of getting this time log of the hole is easily applied when the driller uses the rotary method. This drilling-time log is widely used because it reveals certain important and accurate information about the formations penetrated. When the data are plotted as a curve, the curve can be read and interpreted in much the same way that an electric log of the well is analyzed. Though its most practical use is in connection with rotary drilling, the time-logging technique can be developed and applied with other methods of drilling as well.

The basic reason the drilling-time log can supply useful information about the formations is that the character and makeup of the material being penetrated by the bit largely determine the rate at which drilling proceeds. This general principle is, of course, as old as the hills to most drillers. Nearly every driller notices changes in the formation by the way the drill acts — that is, whether the rate of penetration speeds up or slows down. But, the value of a systematic record of the drilling time to produce a time log has been overlooked by many.

Factors other than the kind and character of each formation also affect the drilling rate. These include: the weight on the bit, the sharpness of the bit, the diameter of the hole, the jet velocity through the nozzles in the bit and the speed of rotation. For best results, all these factors should be kept as nearly constant as possible so that the drilling can proceed under reasonably uniform conditions. However, careful time records show that none of these mechanical factors influence the drilling rate as much as does the texture of the stratum being penetrated. This fact lends accuracy to time-logging. Although the driller ought to do his best to keep the mechanical drilling conditions as uniform as possible, some variations in them do not seriously affect the time log.

Clean sands usually drill very fast; clay, shale and rock drill slower. Loose sand drills faster than cemented sand. Similarly, clean sand drills faster than mud-filled sand. The drilling-time log made up as a curve or diagram to show time for each foot of depth reveals at a glance all changes in the rate of penetration of the bit. Each appreciable change indicates the location of a change in the formation being drilled. Thus, the top, bottom and thickness of each formation can be read from the diagram. For example, when drilling in clay or shale interbedded with water-bearing sand strata, you can definitely see the depth to the top, the thickness and the depth to the bottom of each sand bed from the drilling-time log. Comparison of the drilling rates in the sand beds themselves permits an estimate of the variations in looseness of the sands.

DRILLING–TIME LOG

| DEPTH From | DEPTH To | DRILLING TIME min sec |
|---|---|---|
| 219 ft. | 220 | 4' 05" |
| | 221 | 4' 10" |
| | 222 | 3' 50" |
| | 223 | 3' 55" |
| | 224 | 3' 48" |
| | 225 | 4' 30" |
| | 226 | 4' 35" |
| | 227 | 4' 30" |
| | 228 | 4' 48" |
| | 229 | 4' 50" |
| 229 | 230 | 4' 50" |
| | 231 | 45" |
| | 232 | 52" |
| | 233 | 12" |
| | 234 | 11" |
| | 235 | 08" |
| | 236 | 08" |
| | 237 | 07" |
| | 238 | 11" |
| | 239 | 12" |
| 239 | 240 | 12" |
| | 241 | 09" |
| | 242 | 12" |
| | 243 | 18" |
| | 244 | 12" |
| | 245 | 16" |
| | 246 | 23" |
| | 247 | 27" |
| | 248 | 42" |
| | 249 | 1' 06" |
| 249 | 250 | 42" |
| | 251 | 1' 05" |
| | 252 | 1' 19" |

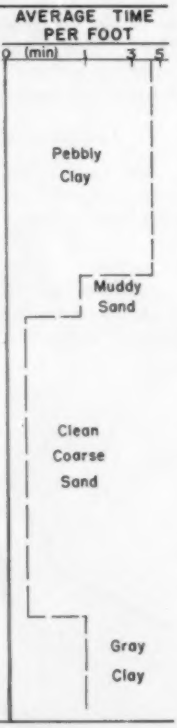


Figure 1. Drilling-time log while penetrating 32 feet of glacial material with a 4¾-inch cone bit operated by a Sullivan 200 drilling machine. Average time per foot for each stratum was calculated to plot the curve shown.

Drilling-time graphs help materially when comparing the relative positions of various geologic formations from one drill hole to another, especially when several thin beds are encountered that cannot be readily identified from samples of cuttings. In this connection, the drilling-time log together with the electric log of the same hole will provide the most accurate means of locating formation changes or boundaries.

### Record of Drilling Time

To make an accurate record, the driller must time the downward movement of the drill stem and call off the minutes and seconds for each foot of hole as it is drilled. First, mark each foot of the kelly with chalk, or by some other means, so the driller can see when each foot has been completed. Second, provide a suitable timing watch that permits reading minutes and seconds easily. Third, provide record sheets on which a helper can write the actual time called off by the driller when each foot mark passes the rotary table or other reference point.

Once drilling commences, let the bit penetrate as it will under the weight of the drill stem. If a pull-down is used to speed up penetration in a thick clay stratum, show the exact time the pull-down device is engaged and disengaged. In this way the effect of the pull-down can be taken into account later when the time log is being studied.

In deep holes that require keeping the drill pipe in tension, hold up with as even a weight as possible. For best results, use a weight indicator to control this load. This mechanical device is connected in the dead line of the hoisting cable to show the exact pull in pounds with which the string of drill pipe is being held up. Maintain regular and even pressure on the fluid with the mud pump. Rotate the drill stem at constant speed. The size of the hole makes little difference in the character of the log, although one size of bit will drill at a different rate through all formations than will another size of the same type.

Call off the minute and second as each foot mark passes the top of the kelly bushing. The bit will often penetrate a foot of clean water bearing sand in six or eight seconds, therefore, one must be alert and call the time intervals accurately if a good log is to be obtained. When drilling in rock,

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on the other hand, timing to the nearest minute may be accurate enough.

Record the time that drilling is stopped for any reason, including stops to add drill pipe. Similarly, record the exact time drilling is resumed.

Accurate records of depth are obviously just as important as accurate timing. The length of the bit and subs must be added to the length of drill pipe in calculating the depth at any instant. When a new length of drill pipe is added, the time log must be resumed at the exact depth at which it was interrupted. If cuttings have settled out in the hole, some re-drilling must be done before beginning to drill new formation. It should also be pointed out that the same weight must be on the bit when it starts drilling new formation, after making a connection, as was on when it left off.

Although we have referred several times to keeping a constant weight on the bit, this cannot always be done in water-well drilling. Each length of drill pipe added to the drill stem puts that much more weight on the bit. However, this gradual increase of weight with depth can be taken into account when studying the time log. Since interpretation of the time log is a relative matter, the gradual increase in weight on the bit will not seriously affect the accuracy of the final results.

### Preparing the Log for Study

In water-well work, most drilling-time logs can be interpreted directly from a simple tabulation of depth and time for drilling each foot. This table is made from the field record as shown in the first three columns of Figure 1. Figure 1 is a log of a 32-foot section of a test hole drilled in glacial material. Drilling was timed with a wrist watch equipped with a large second hand.

If desired, the tabulated data may then be plotted in graphical form. The right-hand column of Figure 1 shows how the log curve looks if the average time per foot for each stratum is plotted against depth. Plotting the average time per foot in this way is all right where the formations are several feet thick, but some of the accuracy of the log is lost.

Figure 2 shows a portion of a log of the Dakota sandstone in a locality where several thin layers of sand are found interbedded within shale layers. The curve on the right-hand side in this case shows the time for each foot of drilling plotted against depth. This method reveals all the detail of the log as taken by the driller and permits more accurate interpretation of the log. This curve is also more readily compared with the electric log, if desired.

A third method of plotting, which exaggerates the rapid drilling through soft formations, is to calculate the "drilling rate" in feet per hour and plot these values against depth. For example, a drilling time of 15 seconds for one foot represents a drilling rate of 240 feet per hour; one minute for a foot interval represents a rate of 60 feet per hour; and four minutes for a foot interval is a rate of 15 feet per hour. When these rates are plotted, the resulting curve is even more like that of an electric log and thus the two are more easily compared.

A drilling time report form in pads is available from commercial stationery stores. This form, designed primarily for use in oil-well drilling, is well-suited for recording time and depth when drilling in rock formations. Figure 3 shows a sample of such a form.

For more elaborate time logging, a mechanical instrument that automatically records drilling time is available. This instrument, called a Geolograph, can be rented but not purchased. A revolving drum carries a long strip of paper that is graduated in hours and minutes. The drum is turned by a special clock at the rate of two revolutions per 24 hours. The instrument is hooked up to the drill rig by a light cable that leads off a small reel on the back of the instrument. The cable runs to the top of the drilling derrick, then over a small sheave and down to the top of the kelly swivel, to which it is attached. As drilling proceeds the cable is pulled off the instrument reel and a stylus pen marks the time-log paper when each foot of hole has been drilled. Each time a new length of drill pipe is added, the pen is re-set to resume marking where it left off.

A second stylus pen on the instrument records the non-drilling time spent

*(Continued on page 14)*

DRILLING—TIME LOG

| DEPTH From | To | DRILLING TIME—EACH FOOT Min Sec | Time—Log 0 1 2 3 4 5 |
|---|---|---|---|
| 364 ft | 365 | 2′ 50″ | |
| | 366 | 2′ 30″ | |
| | 367 | 3′ 00″ | |
| | 368 | 2′ 30″ | |
| | 369 | 30″ | Sand |
| 369 | 370 | 35″ | |
| | 371 | 2′ 40″ | |
| | 372 | 2′ 50″ | |
| | 373 | 2′ 00″ | Shale |
| | 374 | 1′ 05″ | |
| | 375 | 1′ 00″ | |
| | 376 | 35″ | |
| | 377 | 1′ 20″ | |
| | 378 | 2′ 00″ | |
| | 379 | 2′ 10″ | |
| 379 | 380 | 40″ | |
| | 381 | 50″ | |
| | 382 | 1′ 30″ | |
| | 383 | 2′ 00″ | |
| | 384 | 3′ 10″ | |
| | 385 | 2′ 45″ | |
| | 386 | 45″ | |
| | 387 | 45″ | |
| | 388 | 45″ | Sand |
| | 389 | 55″ | |
| 389 | 390 | 1′ 10″ | Shale |
| | 391 | 55″ | |
| | 392 | 1′ 00″ | |
| | 393 | 1′ 10″ | |
| | 394 | 2′ 00″ | |
| | 395 | 2′ 40″ | |
| | 396 | 1′ 45″ | |
| | 397 | 1′ 35″ | |
| | 398 | 1′ 40″ | |
| | 399 | 1′ 45″ | |
| 399 | 400 | 55″ | |
| | 401 | 45″ | |
| | 402 | 45″ | |
| | 403 | 40″ | |
| | 404 | 50″ | |
| | 405 | 1′ 00″ | |
| | 406 | 1′ 10″ | |
| | 407 | 2′ 45″ | |
| | 408 | 3′ 00″ | |
| | 409 | 4′ 30″ | |
| 409 | 410 | 3′ 40″ | |

**Figure 2. Log of Dakota formation drilled by Sullivan 200 rotary using a 4¾-inch cone bit. Actual time to drill each foot was plotted to produce the curve shown. Note its similarity to the curve of an electric log. Actual log of the test hole based on the cuttings plus interpretation of the drilling time has been added on the right.**

DRILLING TIME REPORT

COMPANY _____ COUNTY _____

_____ SEC _____ TWP _____ RANGE _____

NO. _____ TYPE OF RIG _____

TYPE OF INDICATOR _____ MUD WEIGHT _____

WEIGHT ON DRILL PIPE _____ MUD VISCOSITY _____

R.P.M. ROTARY TABLE _____ CONTRACTOR _____

| DEPTH FROM | DEPTH TO | ACTUAL DRILLING TIME BEGAN | ACTUAL DRILLING TIME ENDED | MINUTES PER | REMARKS | BIT NO. |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

**Figure 3. Sample of form for drilling-time report used in oil-well drilling.**

**RECHARGING EFFORTS INADEQUATE**

# Refilling Our Wells

*by* GRANT CANNON

*Continued from September-October issue*

The cheapest method of recharging our underground reservoirs is to increase the inflow of water at the natural recharge area. This method consists of flooding or running water through ditches over land which is porous enough to permit the water to filter down into the aquifer. In some sections of California, mountain streams have been diverted from their natural channels and directed into long ditches winding over the recharge area. In other parts of the state, they have built shallow ponds over this porous earth where water can be made to flow into the aquifer. In the Los Angeles area, water spreading is expected to stop the inflow of sea water which was ruining the aquifer.

The major problem in this type of recharge is to prevent silt or bacterial growth from clogging the porous topsoil and preventing the downward flow of water. The muddy water that follows a flood is usually by-passed because of silt, and the flood basins and ditches must be cleaned of this fine soil periodically. Bacterial contamination, where it becomes a problem, is fought with chlorination.

There have been several rather fancy variations on these basic methods of recharge. In Dayton, Ohio, the city's water supply comes from a group of wells located on an island in the Mad River. In this way the city takes advantage of the induced recharge from the river. But when the water table is found to be going down, dams on the river raise the water to a point where it can be brought onto the island and run through channels over the sandy surface. This double-barreled attack brings about an immediate raising of the water table below.

In Canton, Ohio, the city has located two aquifers, a shallow one and a deep one below it, neither of which in itself has an adequate supply of water. By tapping both strata, it is possible to draw on the upper aquifer and direct its water through the impervious layer between the two so that it recharges the lower aquifer from which the city draws its water supply.

Photo by Drennan Photo Service, Mineola, N. Y.

In Nassau County on Long Island, New York, many large recharge basins like this one have been constructed to collect storm run-off in built-up areas and permit this water to percolate into the underlying formations. This means of recharging ground-water aquifers has been employed in Nassau County since 1936.

### Efforts Are Inadequate

Our efforts to recharge, however, are pitifully inadequate for the future. In the high plains of Texas, water is being pumped out at the rate of twenty times the amount that is going into the aquifer, without an adequate means of artificial replenishment or any alternate source of supply — and when the water-bearing sands have been pumped dry, the rich irrigated area around Lubbock will face ruin.

In Louisiana, Arkansas, Arizona, New Mexico, Nevada, and Utah we know that

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Mr. Cannon, a native of Utah, now lives in Ohio where he is managing editor of the *Farm Quarterly*. He has long been concerned with the conserving of our natural resources and here discusses the basic problem of recharging our underground water reservoirs.

Photos courtesy D. C. Muschel, Western Soil and Water Management Section, Agricultural Research Service, USDA.

Spreading basins formed by cross walls laid across the narrow valley of Cucamonga Creek in southern California where the stream emerges from the canyon. The low dams spread the water over the greatest possible area to get maximum infiltration.

Dikes constructed on 6-inch contours to form spreading basins on gently sloping land. Depth of water varies up to maximum of 12 inches. The soil is fine sandy loam. Recent tests show spreading on alternate narrow strips may improve rate of recharge.

there are areas where overpumping is steadily depleting the underground water reservoirs. The really alarming thing is that we have such meager knowledge of our total underground water supply and the amounts that are being withdrawn from it.

The first step is one of bookkeeping and research. The location, extent, and capacity of the aquifers of the United States must be measured, together with the amounts of water that are currently being withdrawn. Then an accurate estimate of our future water needs must be made and better methods must be found for measuring the capacity of aquifers and for replenishing them.

An experiment run by a government geologist, D. J. Cederstrom, at Williamsburg, Virginia, revealed the fact that an aquifer which had been contaminated with salt water could still be made useful for storage by floating fresh water on top of the salt water, like floating cream onto a cup of coffee.

**Uses Irrigation Water**

Another recharge experiment will start in the Grand Prairie region of Arkansas this year. This is the center of the largest rice-growing region of America, where for years the planters have been pumping deeper and deeper wells to draw more water from the aquifer than is going into it. Roger Baker, the geologist in charge of this experiment, plans to use the irrigation water, which must be drained off the pondlike fields of rice at certain stages in their growth and usually creates a great drainage problem, and run it back into the aquifer through recharge wells.

These are important experiments which will give us information we badly need. They are steps in the right direction, but they are only halting steps.

We must have information to give to farmers so that they can follow the lead of the King Ranch in replenishing the underground reservoirs (and remember that almost every farm with a farm pond has a surplus-water problem sometime during the year). At the present time we do not have enough facts to give to state legislators who want to encourage such practices by passing good water laws.

The greatest part of this work is currently being done by an understaffed, underfinanced branch of the U.S. Geological Survey. If there is any doubt as to the necessity of more awareness of the problem, one need only point to the fact that outside of California not a single flood-control plan on the books today calls for the use of our vast underground reservoirs as a place to store dangerously overabundant water, nor even for the study of such a possibility.

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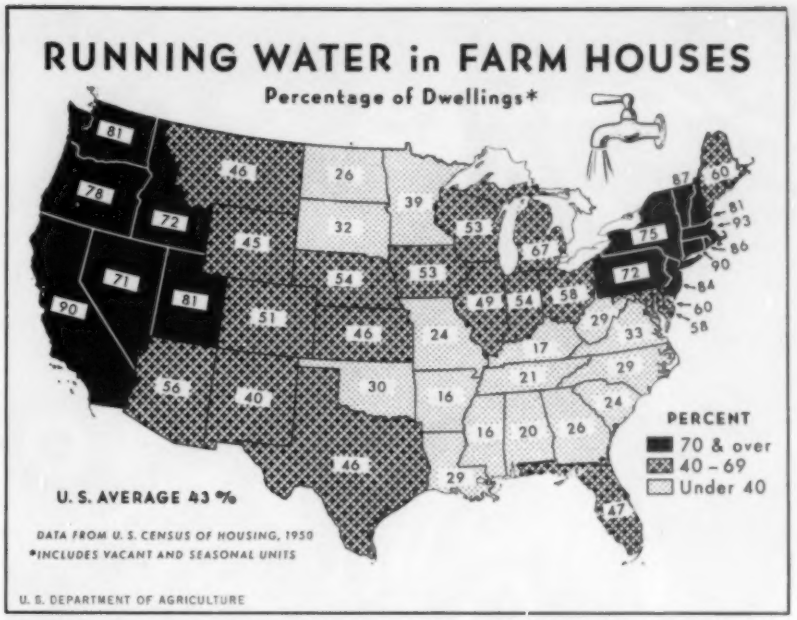



This map shows that the demand for running water in farm homes is far from satisfied. The market for new and improved farm wells runs parallel to this picture and this spells business for well drillers.

In 1953, a total of 702,051 domestic water systems were sold, according to the Bureau of the Census. This topped the 1952 figure of 682,017 units by 3 per cent.

Of the 1953 total, 470,000 systems had jet pumps, 197,000 had non-jet pumps and 35,000 employed submersible turbine pumps. Hand and windmill pumps, sold separately from complete systems, have declined steadily since 1949 to 226,000 units in 1953, which figure includes 163,000 pitcher pumps.

This whole picture gives concrete evidence of the importance to the farmer of an adequate, sanitary water supply. His needs increase each year.

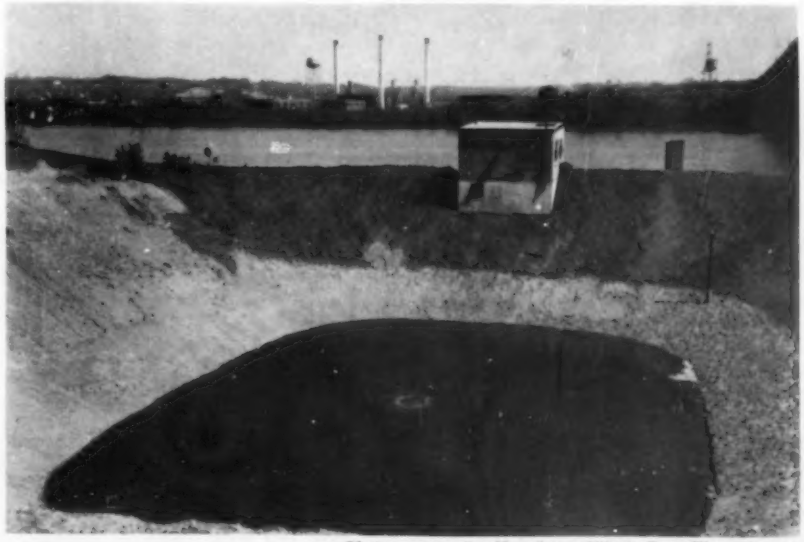
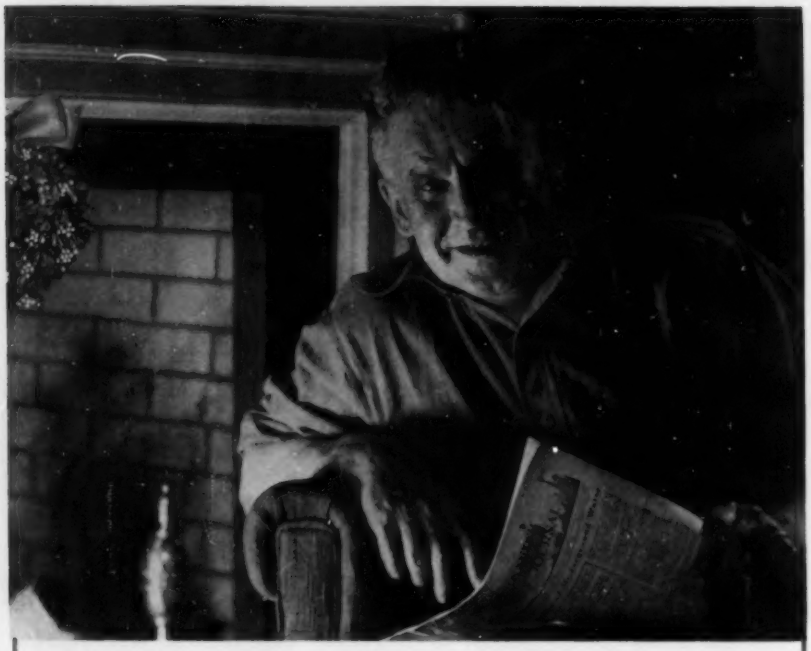


Photo courtesy Dr. Max Suter, Illinois State Water Survey.

**Experimental infiltration pit constructed by Peoria industries and Illinois State Water Survey on the bank of the Illinois River at Peoria. River water is admitted to the pit from late October until May when the water temperature is below 60° F. and when the turbidity is low. Recharge to underlying sands and gravels has been from a high of about two million gallons per day to a low of 0.8 mgd. A total of 77 tons of silt entered the pit with the water during the past season. The infiltration rate varies with the deposition of the silt and various means of cleaning the pit to maintain a high rate are being tried.**



At this time of th' year, we should take an inventory of th' assets that don't show up on our books. Here's some of th' things we Americans possess—

Peace — Prosperity
Freedom — Faith in th' future

With these things to build on, I can REALLY wish you all a

*Merry Christmas*
*and a*
*Happy New Year!*

Tom

Dear Fellows,

I can't believe it. It doesn't seem possible that another year has rolled around an' that Christmas is right at our doorsteps an' we'll soon be puttin' up new calendars. It ain't been a bad year, either, as far as I'm concerned, an' most of th' drillers I know. Lots of us have had years that did a little better by us as far as money is concerned; but most of us will rate 1954 in with th' best years rather than th' worst years. At least we ain't been sittin' quite as close to the edge of our seats as far as big troubles like wars an' depressions are concerned. So I'm puttin' 1954 down in my book as a good fellow. I hope you can do th' same — an' that 1955 will be as good to us.

Two funny things happened to us this season that fooled us fer right. I'll tell you about 'em as a sort of "who-done-it" story. Th' first one was th' case of th' pumps that ran just fine but didn't give any water. They were in wells at a canning factory. As usual, it happened right in th' busy season. They had finished their pea pack an' were jest 'bout half way through the corn. They called us up one morning 'round 6 o'clock. Th' wells had gone plum to pot all at once. Not a doggoned bit of water could they get into their water tank out of either of them.

Now, that don't make sense. You can have two wells drop off gradually together. Or you can have one well go flop real quick-like. But you can't have two go out right together unless there's a rat in the oat bin.

It was an old installation but it had been kept in good shape. The pumps had been shut down while they were havin' th' electricians repair some damage that had been caused by a fire in th' power room where th' pumps were located. After th' fire they had fixed things up with temporary stuff. Then they got ev'rything ready for a quick job o' permanent fixing by shuttin' down at noon one day an' fillin' their water tank before cutting off th' power fer th' pumps.

There wasn't any drawdown gauge in th' wells, so we couldn't tell what was happening there. We started th' pumps. They seemed to run O.K.; but we shut 'em off after lettin' 'em run a couple of minutes an' then had 'em make a telephone call that got 'em fixed up in 'bout one hour. What's your guess about what we found wrong? I'll tell you at the end of th' story.

The next job was quite a bit different. It was a well fer a milk plant an' there wasn't any rush on it. It had been gradually dropping off over quite a spell. This well didn't have any gauge line in it, either; so they didn't have a record on th' drawdown but they did know how much it was pumping. It was giving about 200 gpm when it was first put in back in 1946. They didn't notice any drop-off until about six months before they called us — an' it was a month later before we pulled onto th' job.

When they called us, they checked how long it took to fill their tank when ev'rythin' was shut down, an' they figured they were gettin' between 130 and 150 gpm. They didn't have much tank storage an' this was gettin' down a little low fer their needs. Th' way they were set up their storage was too small to carry 'em over much, an' th' pump cut in an' out a little oftener than most installations; but not enough to cause any trouble with its performance.

It was a good well they had. It was an 8-inch job, 137 feet deep, finished in good stuff that used a 60-slot Johnson Everdur screen 10 foot long. When we tested it, we got 200 gpm with only 6 foot o' drawdown at the end of eight hours pumpin'. The water was a good grade — about 200 ppm hardness. It was th' kind th' Johnson people said would be expected to incrust a little an' probably would some day need acid treatment. But we hadn't expected to have it fall off this fast with such a good showin' when it was new.

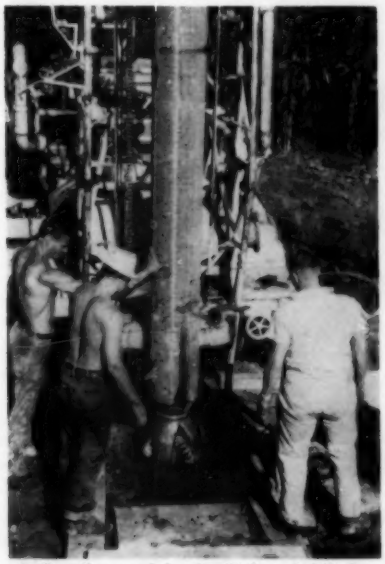
Anyway, it fell off fast th' last month, an' by th' time we got on th' job they was really down to a hand-to-mouth basis. We moved in on a Saturday afternoon; we were all set to pull th' pump, acid treat th' well, clean it an' develop it, put th' pump back, an' have

Glenn Garber of Milwaukee, Wisconsin, drilling 6-inch well for suburban home.

'em goin' again Monday morning. Everythin' was on hand an' we started work within two minutes after th' tank was pumped full. We checked th' pumping rate an' found that by this time it wasn't doing 100 gpm.

When we got into th' job we found we had guessed wrong on this one. What do you think was th' trouble?

Now, right here I want to put in a little plug fer puttin' drawdown gauges in wells. You can't expect 'em to be given away with th' pump. Somebody has to invest a little money in buyin' th' stuff an' goin' to the extra trouble it takes to install 'em. Of course, it has to go into th' price of th' job. But I think it's well worthwhile for th' customer, an' we usually get them to agree to make th' small extra investment. For my part I like to run a copper tube clamped to th' pump column, with a tire valve and a pressure gauge that reads in feet. That gives us th' right reading fer th' static level. We put a sticker showing th' static level and th' date onto th' face of th' gauge on the inside of th' glass. This kind of installation doesn't cost much and you've got information you need when you try to check on what's wrong if th' job causes trouble. Incidentally, if the water in th' well is likely to be corrosive, we use plastic insulators between th' pump pipe and th' copper tube. If they had had a gauge in th' two wells I'm telling about, we would have known what to look for without much guessing.



Drill collar used by Fredrickson Well Company of Hutchinson, Minnesota, on one of their rotary drilling machines. The well being drilled is at Redwood Falls, Minnesota.

Now to get back to these wells. On th' first one it was really easy an' we guessed quick what had happened. Dick took a close look at th' pumps while they were runnin', winked at me, an' told 'em to call back their electrician. When the electrician had put in th' permanent wiring fer th' pumps he had reversed the phases by mistake an' he had th' pumps runnin' backwards. Fortunately, it didn't do any damage. Everybody had a good laugh except the electrician. He had a red face!

Th' second job was not as easy, but we found th' trouble before we had th' pump all th' way out. At th' static water level, th' pump column had pitted real bad and it had two holes clean through—one pretty good size an' the other only about as big as a 20 penny nail. What made these holes come so fast in this water, I don't know, because I've never seen it before in that locality. I've seen 'em go after 15 or 20 years—but this one went in about 8 years. Which is just one more reminder of how little we know about what we're so sure of—especially in th' water well drillin' business.

To finish th' story, we had to have a new length o' pipe column made up; so we went ahead (with th' customers' O. K.) an' treated th' well while we were there. We didn't get much in th' way of results as far as we could see; but when we were all finished with th' job, we tested it, and it was as good as new.

So with that I'll call it quits for 1954. Happy New Year to you!

Yer ol' friend,

Tom

## WELL-POINT SYSTEMS

*(Continued from page 5)*

points must be set just above an impervious layer.

One disadvantage of the center drop tube is that it causes additional head loss in the well-point. The water entering the screen must flow down outside the tube, turn 180° to enter the tube and then flow up through the reduced diameter. Another difficulty is that the presence of the tube prevents any effective development of the formation around the well screen. Where the tube is not used, the development takes place when the points are being pumped and cleaned out preparatory to putting them into operation. This development plays an important role in improving the operating efficiency of each well-point in the system.

### Draining Very Fine Soils

Since we have already spoken of sand-packing of well points in some special situations, it should be pointed out also that sand-packing is of advantage in draining very fine sand of grain size barely larger than silt. The envelope of coarse sand around each screen permits drainage while preventing movement of the fine material into the wells with the water. Through research and experiment our engineering department has worked out the proper gradings of material to use for sand-packing screen in various types of formations and is glad to make recommendations on specific jobs.

The yield from such fine soil will always be low — so low in fact as to raise the question of whether practical dewatering can be achieved. Experience shows, however, that removal of even a small volume of water will stabilize the material in many cases. With the water moving away from the open slopes of the excavation under the constant pull of the well-point system, the surface tension of the pore water in the capillary openings in the soil is a significant factor in stabilizing the banks in addition to the actual reduction in water content of the soil.

**Pictures, Please!**

We can use more pictures of wells and drilling operations. Many readers like to see what other drillers are doing. If you have some good photos, send them along. They will be returned in good condition.

# ASSOCIATION NEWS

*This section is devoted to the exclusive use of water well drillers' associations, both state and local. Notices, announcements, changes of officers and other items should be sent to The Editor, Johnson National Drillers' Journal, 2304 Long Ave., St. Paul 14, Minnesota.*

### North Carolina

H. J. Faw has resigned from the presidency of the North Carolina Well Drillers' Association because he is giving up the contracting business to devote full time to operating a well supply house which he has already started.

C. M. Hudson of Durham, who has been serving as vice-president, becomes president of the Association to fill Mr. Faw's unexpired term.

### North Dakota

The 39th annual meeting of the North Dakota Well Drillers' Association is being held December 9, 10 and 11 at the Clarence Parker Hotel in Minot. A fine group of exhibits is expected and the meeting will certainly draw a good crowd.

An excellent program has been arranged. Every driller in North Dakota should attend and benefit from the convention, and also show his loyalty to the oldest drillers' organization in the country.

### Iowa

The Iowa Well Drillers' Association announces the 1955 meeting, its 26th annual convention, will be held at the Hotel Russell-Lamson in Waterloo on January 26 and 27. Details of the program have not been released but further information will be mailed out soon to all Iowa drillers. Travis Parker of West Branch is secretary; Frank McCutcheon of Des Moines is president.

### Ohio

Plans for the 1955 convention and exposition of the Ohio Well Drillers' Association are being completed. An outstanding meeting is being planned which will be held at the Neil House in Columbus on February 16 and 17.

Almost simultaneously, on February 17 and 18, the Ohio Water Clinic will take place at Ohio State University. Representatives of industry, municipal water departments, consulting engineers and governmental water agencies who attend the clinic are being invited to visit the exhibits at the Association convention. This should be mutually helpful to both groups.

The new insignia of the Association has been completed. Cuts for use on letterheads and advertisements can be obtained from the secretary, R. H. Stein, Box 319, Pemberton.

### Oregon

The Oregon Drilling Association held its annual meeting at Salem on October 29 and 30. A good crowd was present to take part in the fine program arranged for the meeting. Of greatest interest was the cooperative work of the Association with the governor's Water Resources Committee in developing a proposed ground-water code for Oregon. Representatives of the committee, state engineer's office and state health department were present to discuss various ideas with the drillers. In presenting the drillers' points of view, the Association is playing a most important part in this work.

O. E. Jannsen of Clackamas was elected president for the coming year; W. J. Stennett of Oregon City was elected vice-president; and J. A. Jannsen of Clackamas was elected secretary-treasurer.

### Mississippi

The annual meeting of the Mississippi Water Well Contractors' Association at Batesville on September 10 was the best-attended convention the organization has had. A good program and the social events combined to make up an enjoyable day. The group present selected Jackson as the place for the 1955 meeting.

D. C. Trexler of the University of Mississippi discussed with the drillers a plan for a water-well conference at the University. Excellent facilities are available for such a conference and a highly educational meeting can be arranged. All Mississippi drillers interested in such a meeting should contact the secretary, Fred Sutter of Pass Christian.

Photo Courtesy **The Everett Daily Herald**

**C. E. Miller of Everett, Washington, test-pumping the 300-foot well he drilled for the new public utilities building in Everett. Being pumped by air-lift, the yield on test was 400 gpm at 32 feet drawdown. The well is equipped with a 10-inch Johnson Everdur Screen, 45 feet long, with 15 feet of No. 20, 10 feet of No. 30 and 20 feet of No. 40 slot openings. The well is capable of delivering more than 1000 gpm.**

J. R. Lipe of Pope was elected president for the ensuing year. J. C. Reeves of Amory was elected vice-president; and Fred Sutter of Pass Christian was chosen secretary-treasurer. The coming year will see increased activity, interest and membership in the Association.

**VIRGINIA**

An enthusiastic crowd attended the annual meeting of the Virginia Water Well Drillers' Association at Richmond on September 18. Group discussions on subcontracts, insurance, compliance with state health and sanitary regulations, and ethical competitive practices provided a most informative program.

Justus C. Ange of Fairfax was re-elected president and C. R. Lundquist was re-elected secretary-treasurer. The group voted to hold a spring meeting on May 20 and 21 at Roanoke. The Association is making real progress in promoting mutual understanding and higher standards of work among the drillers in Virginia.

**TEXAS**

A record crowd of more than 500 registered for the seventh annual convention of the Texas Water Well Contractors' Association held at the site of the battle of San Jacinto in Houston on July 31. A wonderful day of entertainment and large quantities of barbecued beef made the meeting one that will be remembered.

Four interesting talks were given at the business sessions. The members present elected A. E. Fawcett, Jr., of Houston as president; Arthur Erdman of Falls City as vice-president; T. C. Bussell of Houston as secretary; and F. L. Protsman as business manager.

President A. E. Fawcett, Jr. told the group that the officers and directors would work to increase the membership, to promote a driller's license law and a performance-bond law and to hold district meetings over the state from time to time.

**ILLINOIS**

The 27th annual meeting of the Illinois Water Well Drillers' Association will take place at the Hotel Faust at Rockford on January 12, 13 and 14. A large number of instructive exhibits will be on display in the exhibit hall.

The program of talks and discussions will interest every driller in Illinois. Detailed information about the meetings will be mailed out to all by the service secretary, Robert C. Parks of Urbana.

**KANSAS**

Members and friends of the Kansas Water Well Drillers' Association gathered at Emporia on October 29 and 30 for the seventh annual meeting. Good exhibits and a fine program combined to make the convention enjoyable and worthwhile. Mrs. Hazen Bledsoe organized the ladies' entertainment for a nice group of wives who attended.

At the final business meeting O. S. Fent of Salina was elected president for 1955. O. E. Rosencrantz of Great Bend was chosen president-elect for the following year. W. L. Hendee, Sr., of Muncie and J. M. Jewett continue as secretary-treasurer and service secretary, respectively.

**NEBRASKA**

Another outstanding conference and short course is in the making for the Nebraska Well Drillers' Association. February 16 and 17, chosen by the committee several months ago, are the dates for this 1955 annual meeting. A large number of exhibits is insured. Excellent technical sessions and good entertainment will fill the two-day program. The Nebraska meeting is well-known both for its quality and its popularity among the drilling contractors of the state.

**OKLAHOMA**

A large number of outstanding displays of equipment, well-organized meetings and good technical sessions combined to make the convention of the Oklahoma Drillers' Association in Enid on October 22 and 23, a great success. Some 200 registered for the meeting, including more than 100 water-well drillers. This was a record turn-out for the Oklahoma group.

The program included talks on Oklahoma's ground-water resources, sanitary well construction, ground-water surveys, drillers' license, drillers' responsibility to the public and use of well screens in sand formations.

Several enjoyable events were specially organized for the ladies. The excellent fashion show was most appreciated.

The members elected the board of directors for the coming year which, in turn, selected its officers. V. C. Mickle of Enid was re-elected president, Gene Hopping was chosen vice-president and James Grigsby was selected secretary-treasurer.

**NWWA**

With a total registration of 1,556, the annual exposition of the National Water Well Association broke all previous records. Manufacturers' exhibits took all the available indoor and outdoor exhibit spaces. All exhibits were of outstanding quality.

The technical sessions featured talks on geology, bit dressing, welding techniques, chemical treatment of wells, jet reaming and cement grouting techniques.

The entertainment events were most enjoyable and attended by overflow crowds. The Hon. Walter H. Judd, Minnesota's distinguished congressman, was the speaker at the annual banquet. A recognized authority on foreign affairs, he spoke impressively and with deep conviction on "U. S. Foreign Policy."

Election of officers resulting in choos-

*(Continued on page 15)*

**Help Fight TB**

**Buy Christmas Seals**

This is the 50th anniversary of the sale of Christmas Seals to fight tuberculosis — an idea started in Denmark by Einar Holboell, a postal clerk. In October, 1904, a Committee of Fifteen met in Copenhagen to plan the first issue. Two million seals were printed and sold that year. The proceeds went to build a hospital for tubercular children.

The use of a little stamp to save millions from tuberculosis is one of the most dramatic stories of the 20th century. By buying Christmas Seals, Americans everywhere have joined hands to fight a menace against which each alone is practically powerless.

Coincidence of the 50th anniversary of Christmas Seals with the 50th anniversary of Johnson Well Screens excited more than ordinary interest on our part in the origin of the idea.

In one respect, well screens play an important role in the public health field. They permit development of pure, healthful ground water supplies at costs within the reach of every rural family and every hamlet in our land, as well as larger towns and cities. Wherever ground water exists, everyone can have pure well water.

On this 50th anniversary, we salute the Danish founder of Christmas Seals, those who brought the idea to the United States and those who have worked devotedly and sacrificially over the years to stamp out the "white plague."

# ADVERTISEMENTS

*We will insert advertisements for drilling equipment wanted or for sale, help or work wanted, etc., for our readers, free of charge. Advertisements must be brief, and we cannot assume responsibility for them, but will be glad to put parties in touch with each other by this means and suggest that they investigate any offers or inquiries carefully for themselves.*

FOR SALE: Speed Star 55 drill, 1950 model, mounted on 1940 Chevrolet 1½ ton truck. Rigged to drill 2" wells; some 3" and 4" tools. Rig working daily. Also 6-room house and several lots in small town on northwest coast of Florida at a bargain. J. W. Cooper, Box 101, Freeport, Florida.

POSITION WANTED: Steady working, experienced, sober driller, 30 years old, willing to run any drill for good wages. Now working on irrigation wells in Indiz. Malcolm L. Germon, c/o Edward E. Johnson, Inc., 2304 Long Avenue, St. Paul 14, Minnesota.

FOR SALE: Dempster No. 2 drill mounted on 1942 Ford truck; drill pipe and tools. Also 1948 Ford truck with grain box, stock rack, hydraulic hoist and 600-gal. tank. Price $3,000. Melvin Ostrander, Gordon, Nebraska.

FOR SALE: Three Bucyrus-Erie 22W drilling machines mounted on good trucks. No tools. Price, $4,500 each. Harry H. Fox, Route 6, Shelbyville, Indiana; phone Waldron 4181.

WANTED: Drillers for year round work. Must have good experience record on big hole and deep rock drilling and be competent to run job and supervise. Character references required. Hydro-Matics Corporation, Box 616, Milan, Illinois.

FOR SALE: Or will trade. Swivel rope socket, 14' stem, 5" bit, bailer, set of jars with 1⅝ x 2⅝ - 7 API joints. O. E. Lewis, Darlington, Indiana.

WANTED: Sober, hard-rock driller with at least 10 years experience. Must know bit dressing. High wages for right man. Steady work, all year, in eastern New York. Richard Carroll, Carmel, New York; phone Carmel 5-4486.

FOR SALE: All-steel, cable-tool drill similar to B-E 22-W, roller bearings, will swing 1500 lb. of tools. Extra-long-stroke walking beam, 2 cat-heads. Mounted on 2-ton Reo truck, 1947 model. All in fine condition. C. C. Rasmussen, Ida Grove, Iowa; phone 45 or 174.

POSITION WANTED: Young married driller, five years experience in all types of rotary drilling wishes job. Charles C. Nelson, 804 Osage, Salina, Kansas.

FOR SALE: Ferguson drilling machine with eccentric drop tool, in good condition. Will drill to 600 feet. Can be mounted on truck. Price $650. Virginia J. Slaton, Box 163, Bokchito, Oklahoma.

FOR SALE: New 3" Bucyrus-Erie bit, 7' long, 1⅛ x 1¾ pin; $25. Two Beco drive belts for 21-W; $20 each. Elevator for 1¼" pipe; $5. FOB Troy, Alabama. All new, never used. W. G. Law, Troy, Alabama.

FOR SALE: Bucyrus-Erie 36L drill, serial #16495 with Buda gasoline engine, $8,000. Now drilling near Chicago. Box REM c/o Edward E. Johnson, Inc., 2304 Long Ave., St. Paul 14, Minnesota.

FOR SALE: Water-well service truck, good condition, 1945 model, K-7 International, 196" wheel base; has 34 Tulsa winch with 3-speed take-off, steel bed, headache rack, gin poles, snatch blocks, two 30-gal. saddle gas tanks. Mileage less than 65,000. Price, $1,000. L. F. Bales, 707 N. Broadway, Sayre, Oklahoma; phone 867.

FOR SALE: Failing 44 drill mounted on 1941 Ford; some drill rod and tools. Price $4,000. Box JAM, c/o Edward E. Johnson, Inc., 2304 Long Avenue, St. Paul 14, Minnesota.

FOR SALE: Failing #100 rotary drill mounted on GMC truck; complete with drill stem and 3x3½x4 Gardner Denver mud pump. Box NB, c/o Edward E. Johnson, Inc., 2304 Long Avenue, St. Paul 14, Minnesota.

FOR SALE: Mayhew 1000 drill mounted on 1948 International. ELI M-6 drill 1000' capacity mounted on 1948 Ford. Also 2⅜" and 2⅞" drill pipe. Fred Butler, Box 481, Pueblo, Colorado.

WANTED: Cable tool drilling machine similar to Bucyrus-Erie 24-W or 24-L or 60-L; also another machine comparable to Bucyrus-Erie 28-L. Please give full information as to condition, location and price. Sydnor Pump & Well Co., P. O. Box 1476, Richmond, Virginia.

WANTED: Competent cable tool driller for Bucyrus and Star machines; 6-inch wells, 160 feet to 250 feet deep; plenty of new pipe; bits sharpened in shop. Experienced, careful driller can make 550 to 600 feet per month at $0.75 per foot. Write: Gray Well Drilling Company, Box 181, Delafield, Wisconsin.

WANTED: Young man with some drilling experience and mechanical ability to learn to operate mechanical bit dresser, cut tool joints and do general shop work. Steady work, good chance to advance on sales and commissions. D. E. Edwards, West Branch, Iowa.

FOR SALE: Failing 500 rotary drill on International K-7 truck; 500' drill pipe, bits and tools. A-1 condition. C. C. Rasmussen. Ida Grove, Iowa; phone 45 or 124.

FOR SALE: Mayhew 1000 rotary on 1948 Ford truck with tools, drill pipe, bits; now drilling 30-inch irrigation wells. Franks FA drill, 1500 foot capacity, complete with double drum, break-out table and automatic chuck. ELI rotary M7W, double drum, 40-foot derrick, 6 by 6 pump, 28 foot kelly. All priced to sell. Fred E. Butler, Box 481, Pueblo, Colorado.

FOR SALE: No. 40 Cyclone drill, eight months old, mounted on 1953 Ford truck. Has complete string of drilling tools and all the extras. Equipment is like new. Elmer K. Simon, 4870 Monroe Street, Toledo, Ohio.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## IMPROVE YOUR WORK

*(Continued from page 7)*

in hoisting or during shut-downs. This part of the record gives a tell-tale history, not only of the time required to drill each foot of hole, but of all the time used for making drill pipe connections, or any other delays or shut-downs. It is frequently said that many drillers do not like to work on a drill rig equipped with a Geolograph as it "tells on them" for any time they may have wasted. Figure 4 shows part of a record made automatically by this device.

### Time Logging Pays

The drilling-time log must always be interpreted along with samples of the

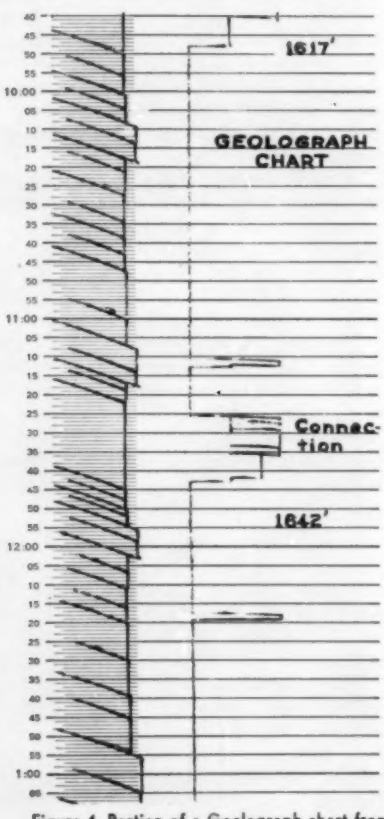


**Figure 4. Portion of a Geolograph chart from which a drilling-time log is prepared. Vertical space between each pair of slant lines represents the time for drilling one foot. Right-hand portion shows time used in adding drill pipe or in other delays.**

cuttings. Time logs should be obtained for exploratory holes, especially when you want to locate "tops" or boundaries of the formations penetrated. It gives you one more measure of the physical properties of the material being penetrated — namely, the rate at which a drill penetrates one foot. Although a driller's impressions of rates of drilling are important, a drilling-time log recorded in writing carries a lot more weight in conveying the driller's findings to the owner.

Cases where a driller has obtained some water from a well without knowing what formation the water was coming from are not uncommon. On one job, for example, a small test-hole was drilled alongside a large hole in which circulation was "lost." From an accurate time log of the small hole, the lost-water zone was found a considerable distance above the bottom of the large hole. Many other cases could be cited where time logs played vital roles in interpreting underground conditions correctly and saved drilling contractors lost time and wasted effort in completing wells.

The alert drilling contractor will do well to take full advantage of the simple technique of taking and using drilling-time logs. They pay off!

## ASSOCIATION NEWS

*(Continued from page 13)*

ing James E. Wright, Jr., Indio, Calif., president; W. Calvin Falwell, Lynchburg, Virginia, president-elect; Robert L. Clark, Stockton, Calif., secretary; and Wm. A. McElhiney, Brookfield, Illinois, treasurer. Howard Andrews of Idaho Falls, Idaho, was chosen vice-president of the Contractors' Division. The Technical and Manufacturers' Divisions are headed by T. P. Ahrens of the Bureau of Reclamation and S. A. Stone of Bucyrus-Erie Company, respectively.

### IDAHO

The directors of the Idaho Drillers' Association met on November 3 at Jerome. Charles Cope reported for his committee on the tool-listing plan to make possible tool exchanges among members. Francis Veach reported for his committee on safety measures.

Plans for the 1955 convention to be held at Shore Lodge near McCall, June 27 to 29, were discussed. Clifford Hosack was appointed chairman of the convention committee.

The board also talked over plans to promote local meetings of drillers at various places in the State.

**O'Connor Well Company of Spring Green, Wisconsin, setting 8-inch Johnson Everdur Well Screen, 30 feet long, and testing well after completion, for the Baraboo Concrete Products Company of Baraboo, Wisconsin. The screen has No. 35 slot openings. The well is 230 feet deep; static level is 150 feet. The well was test-pumped at 354 gpm for 10 hours with 7 feet of drawdown, completely sand-free.**

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# Christmas Greetings

*"Glory to God in the highest*
*and on earth peace*
*among men of good will"*

Genuine good will, sought after in every area of life, is a priceless asset. Destroy it—and you destroy the things that make life.

During 1954, an overflowing measure of good will has come our way from our customers and business friends. Your confidence in us sets a new mark to live up to in the New Year. Our best efforts in 1955 will be spent in your behalf.

As befits "men of good will," we wish you, one and all, the joys and depth of feeling that spring from the true Christmas spirit!

*Merry Christmas and a Happy New Year*

**EDWARD E. JOHNSON, INC.**